

**Evaluation of Electronic Medical Recording
System in Trisuli District Hospital, Nuwakot
2018**

ABBREVIATIONS

EMR	Electronic Medical Recording
ER	Emergency Room
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HMIS	Health Management Information System
IPD	In Patient Department
KII	Key Informants Interview
MCH	Maternal and Child Health
MoH	Ministry of Health
NHRC	Nepal Health Research Council
OPD	Out Patient Department
TDH	Trisuli District Hospital

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EXECUTIVE SUMMARY

Electronic medical recording system that stores the data of patients and other hospital related information electronically is being used globally with the objective of bringing about major changes in health care system, saving health care cost, reducing medical errors and improving performance of health system, electronic medical record (EMR) systems is being widely adopted. In context of Nepal, the Korean and the German government are currently supporting the Ministry of Health and Population (MoHP), Nepal in improving measurement and accountability in Nuwakot District by introducing EMR at the district hospital using open-source technology. Introduction of EMR in health care system of Nepal can be a major push towards evidence based decision making in Nepal. Nepal has its own unique challenges in introducing EMR with very limited use of technology in health care setting, low level of computer literacy, constraints in human and financial resources. Documenting the effectiveness, facilitators, barriers and challenges in implementation of EMR in Trisuli District Hospital can give evidence on whether such program would be effective in other hospitals in days to come. In this context, this study was designed to assess the changes in quality of data after implementation of EMR, readiness of the hospital staffs, potential benefits, facilitators, barriers and challenges in implementation of EMR in Trisuli District Hospital.

Mixed method study was carried out that involved Key Informant Interviews and Focused Group Discussion as qualitative method of data collection and face to face quantitative interview and record review as quantitative method of data collection. Study was carried out in two phases: baseline survey that was carried out before implementation of EMR and an endline survey after implementation of EMR. Purposive sampling was used for selecting participants, from within the TDH, for KIs and FGDs. There were 18 participants in baseline interview for both KIs and quantitative interview. The response rate was 100% in baseline study. However in the endline survey, out of total 18 participants approached for participation, 16 agreed to participate and 2 refused participation. Separate readiness assessment tools were used for medical superintendent and other staffs involved in implementation of EMR. Readiness assessment tool used for medical superintendent covered information on organizational alignment, management capacity, operational capacity and technical capacity of the hospital. Readiness assessment tool assessed the readiness of staffs involved in implementation of EMR on Information Technology (IT) skills, organizational support, expected benefits and motivation and understanding about EMR. Each of these domains had multiple questions which were summed to compute the total score in each of these domains. Record review checklist was used for record review.

Percentage of missing information in patients' record on ethnicity, age, gender, district, VDC/Municipality and ward. However, the proportion of missing information seems to have increased in case of other variables like investigation and provisional diagnosis was seen after implementation of EMR. Reduction in duplication of task, availability of accurate and updated information, financial transparency, less chance of data loss, prevention of medical errors, reduction in cost of papers and printers, easiness in evaluation of staffs performance and easiness in financial and logistic planning were key benefits that participants shared would be achieved through implementation of EMR.

Implementation of EMR also drastically reduced time taken to prepare summary about the patients visiting hospital in a day and reporting time to HMIS 9.4. Relatively more participants in end line study said that they used data in influencing different decision made within the hospital after implementation of EMR.

Good team work, willingness of the staffs, commitment from government for sustainability of the program were facilitators in implementation of the EMR while the implementation was hindered by factors like high turnover and frequent transfers of staffs, technical issues like frequent power cutoff, slow server, inadequate backup plan, inadequate manpower for regular repair and maintenance. Participants also shared their experience that patients feel that they are not being paid attention while health personnel consistently look into computer screen for profile of patients and recording of information. Participants suggested that having the system in Nepali language would make it more useful and user friendly.

Despite multiple barriers and challenges, implementation of EMR seems to have positive impact on quality of data, use of data in decision making process and improving efficiency in hospital.

INTRODUCTION

Most medical records are still stored on paper, which can be of little use in planning process and reducing medical errors.¹ In recent years, with the objective of bringing about major changes in health care system, saving health care cost, reducing medical errors and improving performance of health system, electronic medical record (EMR) systems is being widely adopted.¹ Electronic Medical Recording (EMR) system stores the records of patients and other hospital related data electronically.² It has been shown that the effective use of information technology (IT) including EMR is essential for the provision of high quality care in the increasingly complex health care field.^{3, 4} It is also supposed to make the delivery of health care, making it safer, more effective, and more efficient.⁵ In country like Nepal, where record keeping system is considered to be relatively poor and evidence based decision making is in preliminary stage, introduction of EMR can help in improving performance of health system.

The Korean and the German government are currently supporting the Ministry of Health and Population (MoHP), Nepal in improving measurement and accountability in Nuwakot District by introducing e-reporting from health facility level as well as introducing EMR at the district hospital using open-source technology.

Previously, patient based data at Trishuli District Hospital (TDH) were recorded on a paper based system. Analysis and use of the data at the hospital was difficult as the process of retrieving data was time consuming. Moreover, the quality of data is often compromised in the paper based patient record system, because of the possibilities for double-counting, transcription errors or missing values. The introduction of an electronic medical record system to support the hospital management would not only improve the quality of the data, but could also support the smooth functioning of the hospital itself. Using electronic medical records for registration of patients, investigation management, lab management, pharmacy management and billing, the hospital supposed to be able to make use of all its service related data and start making decisions based on evidence. With the introduction of EMR, medical recorder of the hospital is supposed to have sufficient time for analyzing the data rather than just entering data for reporting purposes. Patients visiting the district hospital could benefit from shorter waiting times, complete medical records of their visits, and expect more efficient work flows. With the ability to keep track of a particular patient's medical records, the health service providers can provide accurate diagnosis and treatment based on accurate past treatment history.

In order to facilitate efficient recording and reporting of data in hospital, TDH is being supported with the open source solution, Bahmni. Bahmni is a consortium of various other open source initiatives to provide a complete hospital management system that can efficiently handle all hospital related processes. A customized version of Bahmni is used in Nepal in two locations: Bayalpata Hospital in Achham

and Charikot Hospital in Dolakha. However, little is known about facilitators and barriers of implementing Electronic Medical Record (EMR) system in public hospital in Nepalese context. This study is thus envisioned to appraise the effectiveness of implementing (EMR) system in Nuwakot district.

Rational/Justification

Policy makers often encounter lack of data or availability of low quality data in decision making process. Introduction of EMR in health care system of Nepal can be a major push towards evidence based decision making in Nepal. Although there are international evidence on positive changes of introduction of EMR, potential barriers and facilitators of the implementation, such evidences are lacking in context of Nepal. Nepal has its own unique challenges in introducing EMR with very limited use of technology in health care setting, low level of computer literacy, constraints in human and financial resources. Documenting the effectiveness of EMR in Trisuli hospital can give evidence on whether such program would be effective in other hospitals in days to come. Furthermore, assessment of barriers and facilitators give idea of what factors need to be considered or addressed before introduction of EMR. The findings of this study could be useful for other district that are planning or have any plan of introduction of EMR in near future.

Objectives of the study

- To assess the readiness in implementation of EMR in Trisuli District Hospital
- To identify facilitators and barriers of EMR implementation
- To identify the utilization status of data generated through EMR
- To assess the utilization status of EMR data for decision making
- To assess and compare the quality of data before and after introduction of EMR

METHODOLOGY

Study Design

This was a mixed method study carried out in TDH. Study uses the strength of qualitative study in exploring the diversity of issues through Key Informants Interviews (KIs) and Focused Group Discussion (FGD) and changes in quality of data through document review extracting quantitative information. KIs were conducted before and after implementation of EMR to track changes in opinion of people about EMR, potential benefits of EMR, barriers, challenges, facilitators and way forward for improvement of EMR in TDH. Similarly, quantitative interviews were carried out among the staffs involved in implementation of EMR to track use of evidence in decision making process and readiness in implementation of EMR.

Sampling

Purposive sampling was used for selecting participants, from within the TDH, for KIs and FGDs. There were 18 participants in baseline interview for both KIs and quantitative interview. The response rate was 100% in baseline study. However in the endline survey, out of total 18 participants approached for participation, 16 agreed to participate and 2 refused participation. We approached all the staffs in hospital that are expected to be involved in implementation of EMR for participation in the study.

Data Collection Tools and Techniques

We deployed two enumerators in field with Bachelor degree in Public Health for data collection in the field after one day orientation about data collection procedure. Enumerators were trained on record review process and process of conduction of qualitative and quantitative interviews.

We conducted qualitative and quantitative interview of staffs involved in implementation of EMR. Quantitative interview were intended to generate information on readiness in implementation of EMR, use of data in planning process and potential challenges in using data for decision making process. Qualitative interviews were intended to generate rich information on potential benefits of EMR, facilitators, barriers and challenges in implementation of EMR and measures that can be taken to ensure smooth implementation and sustainability of EMR. We also reviewed recorded data to identify changes in quality of data before and after implementation of EMR in TDH. For determining the quality of data, we checked sample records from the paper based reporting system as archived proxy and then compare it with EMR system to determine the quality data. For assessment of quality of data, data of paper based recording system for one months before implementation of EMR and electronically recorded data for one month after implementation of EMR were reviewed.

Separate readiness assessment tools were used for medical superintendent and other staffs involved in implementation of EMR. Readiness assessment tool used for medical superintendent covered information on organizational alignment, management capacity, operational capacity and technical capacity of the hospital. Readiness assessment tool assessed the readiness of staffs involved in implementation of EMR on Information Technology (IT) skills, organizational support, expected benefits and motivation and understanding about EMR. Each of these domains had multiple questions which were summed to compute the total score in each of these domains. Detail tool has been attached in Annexure.

Data Analysis and Reporting

We will carry out descriptive analysis of quantitative data with frequency and percentage distribution of study variables. We will transcribe the KIs and interviews for further analysis of the qualitative data. Initial lists of coding categories will be generated from the transcripts as well as from the body of literature. We will use the coding categories to organize and code qualitative data in Microsoft Excel. We will analyze coded data using Braun and Clarke's (2006) thematic analysis guidelines. We will produce a final report of the evaluation study in English. Research findings from the study will be organized into a manuscript to publish the NHRC Journal and/or relevant GIZ Publication.

Ethical Consideration

Written informed consent was obtained from each of the participants after explaining about the objective of research, voluntary participation, and autonomy to withdraw at any point of time, privacy and confidentiality. Ethical clearance was obtained from Ethical Review Board (ERB) of Nepal Health Research Council.

FINDINGS

Findings from Quantitative component of the study

Table 1: Characteristics of research participants

Characteristics	Years	Pre	Percentage	Post	Percentage
Duration of work	≤ 1 years	8	44.4	6	37.5
	1-4 years	6	33.3	4	25
	≥ 4 years	4	22.2	6	37.5
Supervision responsibility	Yes	11	61.1	9	56.2
	No	7	38.9	7	43.8

The proportion of research participants involved in supervisory roles in baseline study was 61.1% while it was 38% in posttest.

Table 2: Implementation status of EMR

Units	Record keeping system	Implementation status of EMR	
		Baseline study	Endline study
Unit 1: Registration (including Billing)	Yes	EMR Partially implemented	EMR fully implemented
Unit 2: OPD	Yes	EMR Partially implemented	EMR fully implemented
Unit 3: IPD	Yes	Paper based	EMR Partially implemented
Unit 4: ER	Yes	Paper based	EMR Partially implemented
Unit 5: Laboratory	Yes	EMR Partially implemented	EMR Partially implemented
Unit 6: Radiology (x-ray)	Yes	Paper based	Paper based
Unit 7: Store	Yes	Paper based	Paper based
Unit 8: Pharmacy	Yes	Paper based	Paper based
Unit 9: MCH	Yes	Paper based	Paper based

Even before implementation of EMR, Trisuli District Hospital had record keeping system in hospital in all departments. EMR was partially implemented in 3 departments in baseline survey and fully implemented in 2 departments and partially implemented in 3 departments in endline survey. EMR was partially implemented in Registration (billing), OPD and Laboratory in baseline study while it was fully implemented in registration and OPD department in the endline survey. In the endline survey, EMR was partially implemented in IPD, ER and Laboratory.

Table 3: Influence of research participants in the decision making

Type of decision	Pre								Post	
	Yes		No		Yes		No		f	%
	f	%	f	%	f	%	f	%		
Budgetary decision	7	38.9	11	61.1	6	37.5	10	62.5		
Staffing Decisions	7	38.9	11	61.1	9	56.2	7	43.8		
Medical Supplies	9	50.0	9	50.0	11	68.8	5	31.2		
Clinical Services	8	44.4	10	55.6	9	56.2	7	43.8		
Service Improvement	11	61.1	7	38.9	13	81.2	3	18.8		

The table above compares the number of respondents who has influence in decision making in different areas. Out of 18 participants in baseline, 11 participants (61%) mentioned that they had influence in service improvement, 9 participants (50%) said that they have influence in Medical Supply and Drug Management, 8 participants (44%) believed that they influence in planning clinical services and 7 participants (38.9%) mentioned that they have some influence in the budget preparation, staffing decisions, while. Out of 16 participants in endline survey, 13 participants (81.2%) mentioned that they had influence in service improvement, 9 participants (56.2%) said that they have influence in staffing and clinical service related decisions, 6 participants (37.5%) believed that they influence budgetary decisions. Relatively, more participants agreed that they influence in decision making in the end line as compare to the baseline survey

Table 4: Use of data in decision making

Use of data in different decision making	Pre				Post			
	Yes		No		Yes		No	
	F	%	f	%	f	%	f	%
Budget Preparation	3	42.9	4	57.1	6	100.0	0	0.0
Staffing Decisions	6	100.0	0	0.0	9	100.0	0	0.0
Medical Supplies	6	60.0	4	40.0	8	88.9	1	11.1
Clinical Services	5	62.5	3	37.5	5	50.0	5	50.0
Service Improvement	6	54.5	5	45.5	6	85.7	1	14.3

During the baseline survey among the participants who agreed that they influence in decision making, 6 participants (100%) said they use data for influencing staffing decision, 6 (60.0%), used data for influencing medical supply and drug management decision, 6 participants (54.5%) said that they used data in influencing service improvement decisions, 5 participants (62.5%) said that they used data in influencing

clinical service related decisions while only 3 (42.9%) participants said they used data in influencing budgetary decisions participants said they use data for influencing decision on budget preparation. In the end line survey all the staff who influence in the budgeting and staff decisions said they use data for decision making. However, in the endline survey, all of the participants who said that they influence budgetary and staffing decisions said they use data for making such influence. The percentage of participants using data for influencing service improvement and medical supplies was also above 85% each. But for planning clinical services, only 50% accepted that they use data which was relatively lower than the findings in the baseline survey.

Table 5: Problems encountered regarding use of data in last 6 months

Type of Problems	Baseline				End line			
	Yes		No		Yes		No	
	F	%	f	%	f	%	f	%
Delay in producing data	10	55.60%	8	44.40%	8	50.00%	8	50.00%
Data not well presented	9	50.00%	9	50.00%	10	62.50%	6	37.50%
Lack of data analysis skills and interpretation skills	12	66.70%	6	33.30%	9	56.20%	7	43.80%
Lack of time	9	50.00%	9	50.00%	8	50.00%	8	50.00%

The above table demonstrates the problems that are faced while using the data. Slightly more than half (55.60%) of the research participants shared that they had encountered problem due to delay in producing data in baseline study while it was just half (50%) in end line study. Half of participants (50%) had faced problem due to data being not well presented while it increased to 62.5% in endline study. Almost two third (66.70) had encountered problem due to lack of data analysis and interpretation skills while it decreased to 56.20% in the endline study. Half of participants in both baseline and endline study faced problem due to lack of time.

Table 6: Feedback system about challenges in data use

	Response	Pre		Post	
		f	%	f	%
Feedback provided	Yes	14	77.80%	16	100.00%
	No	4	22.20%	0	0.00%
Feedback addressed	Yes	13	86.70%	15	93.80%
	No	2	13.30%	1	6.20%

In the baseline study only 77% said they provided feedback for change about the problem they encountered whereas in end line 100% of the participants said they had provided feedback for improvement. Of the total participants providing

feedback, more than 85% were happy that their feedback had been addressed in the baseline survey and the proportion was increased to around 94 % in the post implementation survey.

Table 7: Adequacy of skills possessed to use the data for decision making

Adequacy of skill possessed for using data	Pre		Post	
	f	%	f	%
Yes	13	72.20%	11	68.80%
No	5	27.80%	5	31.20%
Total	18	100.00%	16	100.00%

Around 72% of the respondents felt that their skills are inadequate to use the data for decision making in the baseline survey whereas nearly 69 % accepted they had lack of data using skill for decision making in the endline study.

Table 8: Training need to use the data for decision making

Area of training need	Pre				Post			
	Yes		No		Yes		No	
	f	%	f	%	f	%	f	%
Data collection	16	88.90%	2	11.10%	12	75.00%	4	25.00%
Data analysis	17	94.40%	1	5.60%	16	100.00%	0	0.00%
Data presentation	17	94.40%	1	5.60%	16	100.00%	0	0.00%
Data use	15	83.30%	3	16.70%	16	100.00%	0	0.00%

In the baseline, 94% of the research participants said they need trainings on data analysis and data presentation, 88.9% said about the need of training on data collection and 83.3% said about the need of training on data use. Similarly, in endline study all the participants said they need training on data analysis, data presentation and data use and 75% said they need training on data analysis.

Table 9: Data and Information presented in the last staff/management meeting

Data Presented	Pre		Post	
	f	%	f	%
Yes	2	11.10%	3	18.80%
No	16	88.90%	13	81.20%
Total	18	100.00%	16	100.00%

The proportion of participants sharing that data were presented in last staff meeting in was 11.10 % in pretest and 18.80% in posttest.

Readiness in implementation of EMR

Readiness in implementation of EMR was assessed at two level: readiness of the medical superintendent who makes major decisions relating to hospital and among

the staffs who are supposed to use EMR as a part of their daily job responsibility.

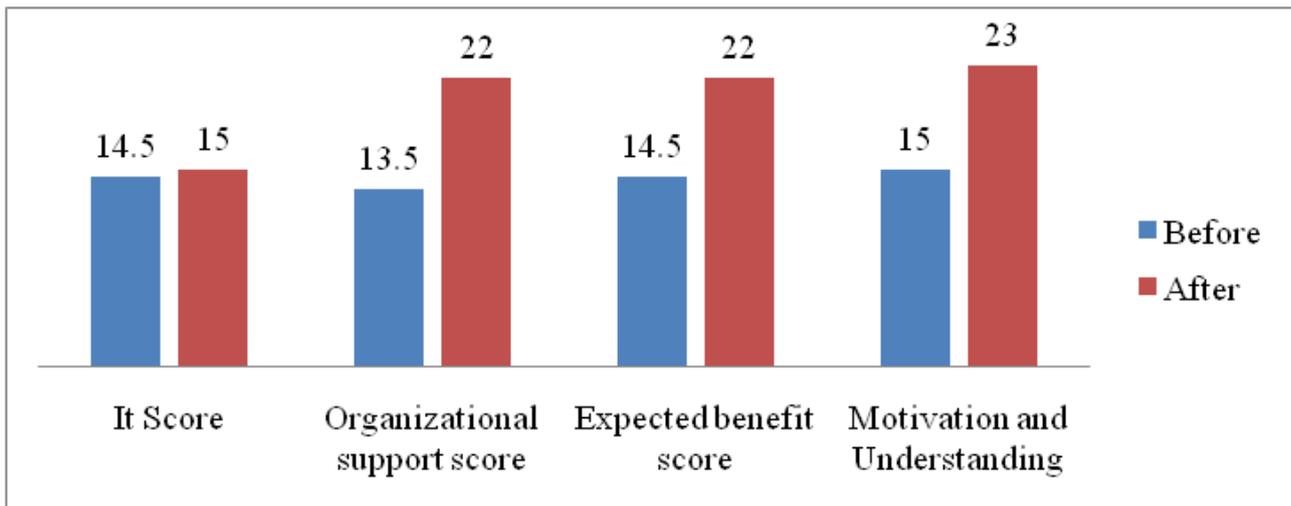


Figure 1: Readiness of staffs in implementation of EMR

Total score for each domains of organizational preparedness i.e. IT support score, organizational support score, expected benefit score and motivation and understanding score was 25. The preparedness score in each of these 4 domains increased after implementation of EMR compared to before implementation of EMR. It support score increased from 14.5 to 15, organizational support score increased from 13.5 to 22, expected benefit score increased from 14.5 to 22 and motivation and understanding relating to EMR increased from 15 to 13.

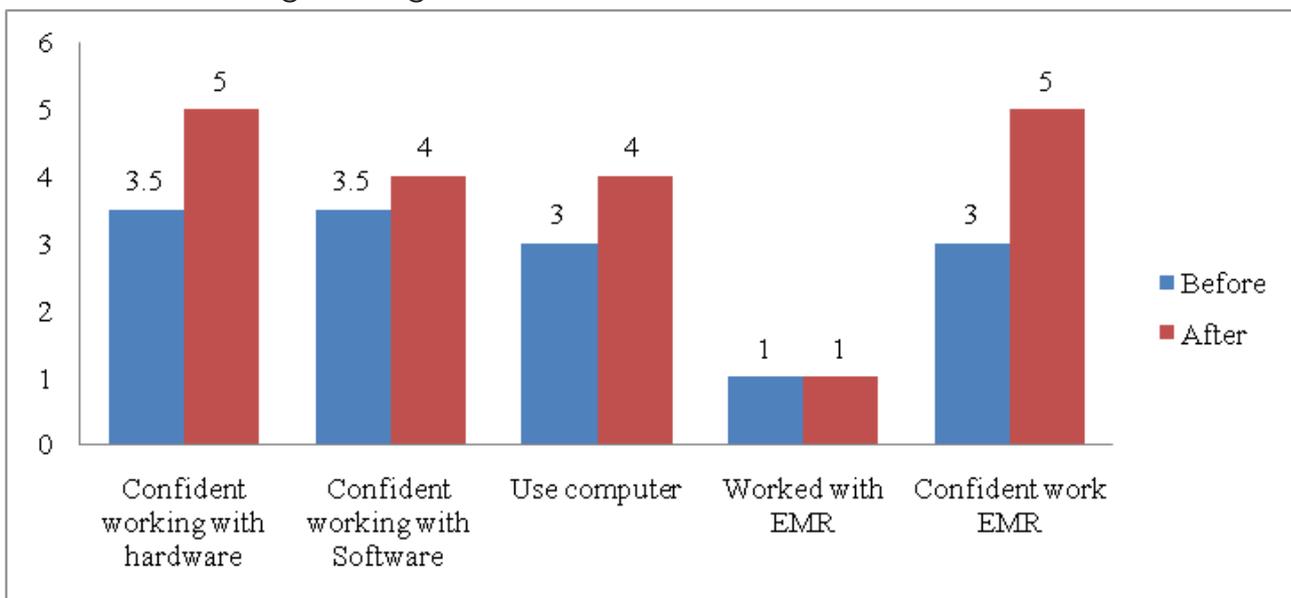


Figure 2: Organizational readiness in IT related issues

Different domains of IT skills like confidence in working with hardware, software, using computer for other purpose like browsing, having past experience of working with EMR and confidence in working with EMR were assessed in the study. Except having past experience of working with EMR, median score changed positively after implementation of EMR. When each of this domain were rated out of maximum

5, Confidence in working with hardware increased from 3.5 to 5, confidence in working with software increased from 3.5 to 4, use of computer increased from 3 to 4, and confidence in working with EMR increased from 3 to 5. While median score was constant in past experience of working with EMR.

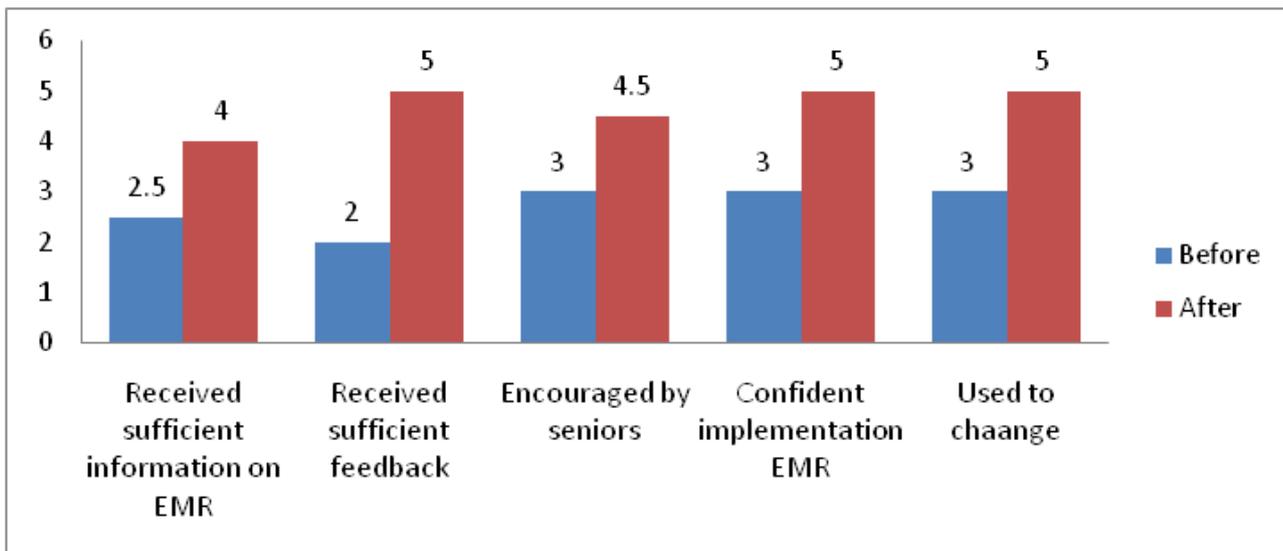


Figure 3: Organizational support on EMR

Organization support for implementation of EMR was measured in 5 major domains i.e. sufficiency of information on EMR, sufficiency of feedback, encouragement by seniors, confidence in implementation of EMR, and tolerance (used to) change. The median score changed positively in all of 5 domains. When rated out of 5, median score on sufficiency of information increased from 2.5 to 4, sufficiency of feedback increased from 2 to 5, encouragement by seniors increased from 3 to 4.5, confidence in implementation of EMR increased from 3 to 5 and tolerance (used to) change increased from 3 to 5.

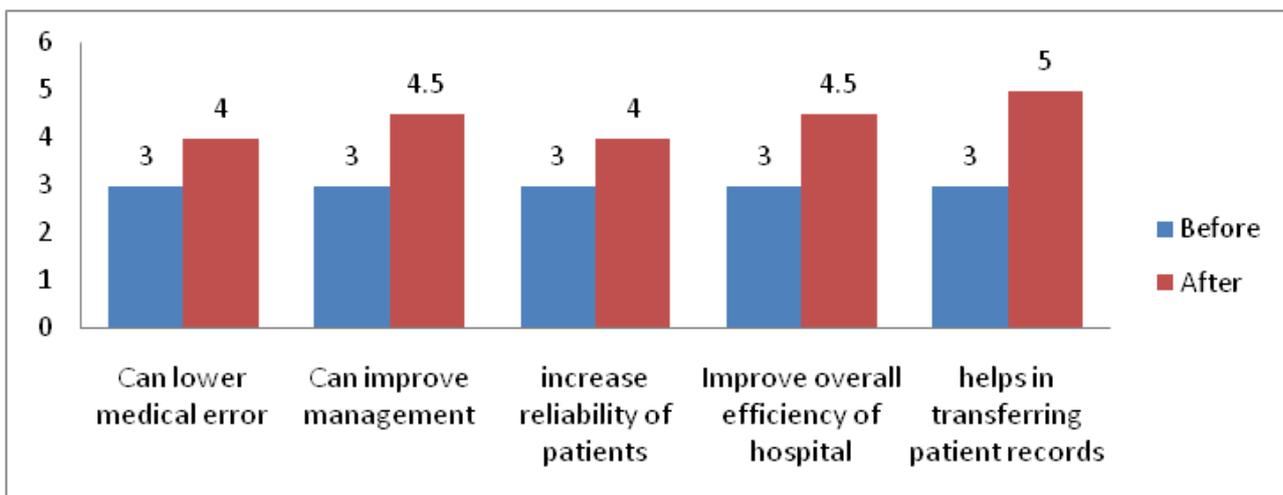


Figure 4: Expected benefit score in different aspect of EMR

The median score participants assigned to expected benefits of implementation of EMR in all five aspects namely role of EMR in lowering medical error, improvement in management, increase in reliability of patients, overall efficiency of hospital

and help in transferring patients record increased positively from baseline study to endline study. The median score participants assigned to benefit of EMR in lowering medical error increased from 3 to 4 while the median score about the role of EMR in improvement in management increased from 3 to 4.5. Similarly, the median score on role of EMR in increasing reliability of patients increased from 3 to 4 improve overall efficiency of hospital increased from 3 to 4.5 and helps in transferring patients record increased from 3 to 5 from baseline to endline study.

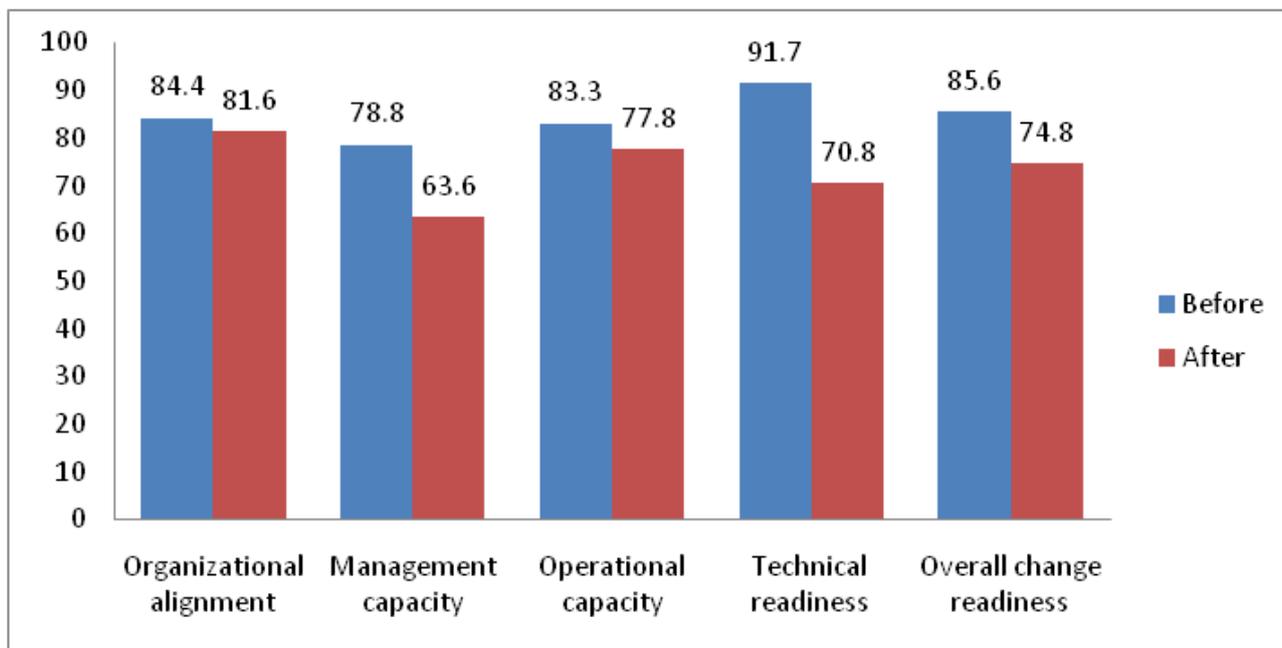


Figure 5: Readiness of Medical Superintendent towards implementation of EMR.

Readiness of medical superintendent seem to have decreased from baseline of study to endline of study in each of the 5 categories namely; organizational alignment, management capacity, operational capacity, technical readiness and overall change readiness. Organizational alignment score decreased from 84.4 to 82.6, management capacity score decreased from 78.8 to 63.6, score for operational capacity decreased from 83.3 to 77.8, score for technical readiness decreased from 91.7 to 70.8 and score for overall change readiness decreased from 85.6 to 74.8 from baseline to endline survey.

Table 10: Missing information in Master register

Indicator	Baseline(%)	Endline (%)
Serial Number	0	0
Registration Number	98.3	0
Name of patient	0	0
Ethnicity	75.7	0.95
Age	0.2	0
Gender	0.3	0
District	99.9	0

VDC/municipality	0	0
Ward	0.3	0
Contact Number	100	100
Types of service use	99.8	0.87

Contact number of the patients visiting hospital was not recorded in both the baseline and endline survey. Name of participants, serial number and name of VDC was recorded in all patients in both baseline and endline survey. While there were positive changes in missing values in case of other indicators from baseline to endline survey. Missing value decreased from 98.3% to 0% from baseline to endline survey period. Similarly, district was not recorded in 99.9% patients in baseline study while it was recorded for all participants in endline survey period. Similarly, information about ethnicity was missing in record of 75.7% patients in baseline study while it was missing in only 0.95% patients record in endline survey.

Table 11:Missing information in OPD register

Indicator	Before	After
Serial Number	0	Not applicable
Master Registration Number	4.54	0
OPD registration Number	99.79	Not applicable
Name of patient	0.21	0
Ethnicity	99.79	0
Age	75.26	0
Gender	61.44	0
District	99.79	0
VDC/municipality	18.56	0
Ward	26.19	0
Contact Number	100	100
Investigation	85.36	88.73
Provisional diagnosis	65.77	97.28
ICD Code	100	97.28
Treatment and counseling	97.73	93.88
Refer from/to facility	100	0.98

OPD registration number was missing in records of 99.79% patients in baseline study while after implementation of EMR in endline survey; the indicator was not applicable as it was auto generated. Endline survey drastically reduces the percentage of missing information in patient's record on ethnicity, age, gender, district, VDC/ Municipality, Ward and information on referral from baseline to endline survey. Percentage of missing information reduced to 0% from 99.79% for ethnicity, 75.26% for age, 61.44% for gender, 99.79% for district, 18.56% for VDC/Municipality, 26.19%

for ward. However, the proportion of missing information seems to have increased in case of other variables like investigation and provisional diagnosis.

Table 12: Time taken to prepare reports

	Baseline	Endline
Number days/month it takes until data is available in HMIS 9.4	Around 7 days	within 1 day
Time it takes to prepare the report for planning within hospital	15 days	Less than one day
Time it takes to prepare the summary for a day	30 Min	within minutes in EMR

* based on interview of medical recorder

The time taken to prepare report or make data available in HMIS 9.4 reduced drastically from around 7 days in paper based system to around 1 day in EMR. Similarly, time taken to prepare reports in paper based system was around 15 days while it reduced to less than a day in endline survey while time taken to prepare a summary of the day reduced from 30 min in paper based system to around a minuet in EMR.

Findings from Qualitative component of the study

Findings from qualitative study are organized in 8 broad themes: understanding about EMR and paper based system, implementation status of EMR, benefits of EMR, role of EMR in decision making, potential facilitators in implementation of EMR, potential barriers, challenges and facilitators in implementation of EMR, potential changes in the system and ways to overcome those challenges

Understanding about EMR and paper based system

Before implementation of EMR, most of the research participants had heard about EMR although they did not have clear understanding on how it works and were not familiar with the system. Before implementation of EMR, most participants had shared that EMR is a modern paperless system based on modern technology that could facilitate the work process through paperless system reducing the task of recording and reporting. Despite potential benefits, participants shared that it needs rigorous efforts and high level of staff motivation for successful implementation.

Some participants opined that the paper based system is much simple and easier as they were familiar with it and shared that use of EMR could be time-consuming as they were not acquainted using computer in workplace. However, participants acknowledged that there are challenges in paper based system while dealing with inventories. Furthermore, participants opined that there are high chances of losing patients information in paper based system while EMR could be safe in this regard. Participants also shared that with advancement in technology, it would be better to opt for electronic recording system so that patients' information can be stored as long as it is required without extra workload.

It's very difficult to manage store inventory in paper based system although some of senior staff feel comfortable using paper based system. I have seen District Public Health Office using software of LMD for logistic management but I use all purchase order, demand form, pharmacy orders and billings all manually using paper based system.

Store In charge

Sometimes they (patients) come saying that they have lost the hospital card. Then we have to start the whole process from beginning as we have no details of the patients. It's waste of time as we have to ask the same information repeatedly to the patients.

Medical Superintendent

I personally feel easy in paper base system. I feel looking at the computer screen and typing is time consuming. Everything has both positive and negative aspect. In EMR we can know the details of the patients even if the card is lost. We can know about the previous vitals, treatment and diagnosis but we cannot give time to patient. We were practicing in paper base system so that we feel easy in it .We write everything such as history of the patient, diagnosis, investigations, and medicine in prescription and finally sign there in paper.

Medical Officer

After the implementation of EMR, they had general understanding that EMR stores the patient information and other treatment history electronically. Participants had been trained on EMR during the post test period which had cleared some confusion relating to EMR that participants had before implementation of EMR. The participants shared that they found this digital system easier than they supposed before implementation of EMR and opined that it had fulfilled the need of the hospital. Participants had contradictory opinion about the time it takes in recording data in EMR and paper based system. Some participants shared that it was time consuming while some believed that it could save time and money as the information of patients recorded once can be used repeatedly. Specially participants who were not familiar in using computer in workplace considered it as time-consuming process while the other who had basic level of acquaintance with computer supposed it to be time saving option. Participants also shared that it would be easy to identify the prevalence and incidence of diseases in local context that would facilitate the planning process in the hospital.

I like the electronic health recording system of the hospital , at first patient comes and their name is entered in counter and the details of the patient comes to our laptop directly and we have to write investigation, and probable diagnosis and tests if needed , system is very good but it's difficult when patient flow is very high.

Medical Officer

In my view we need EMR because in our Trishuli District Hospital patients come

from distant places and when they come after one or two months later for follow up, they usually lose their medical reports and need to be examined from the beginning which is time consuming and disappoints the service providers.

Hospital Manager

Implementation status of EMR

During the pretest, management level key informants briefed that they have planned to implement this system phase wise manner in different departments as it can be challenging to start it in whole hospital at once.. Likewise it was reported that EMR is being considered as positive change by all the levels and staffs because of its usefulness in recording and reporting. Participants had basic orientation about EMR and expecting detail training about how to practically implement it in the hospital. Hospital staffs also had regular discussion about the EMR in meetings of the hospital and informally among the staffs that helped to clarify some issues and broaden understanding.

We have heard that digital system is going to be implemented and we got orientation of one day. In this system no patient need to carry prescription and x-ray reports.

Medical Officer

Though we cannot implement EMR on all departments at once we are gradually implementing it starting from OPD, then lab likewise we are proceeding in it gradually. While doing so, we are facing lots of challenges and obstacles and definitely we can manage such problem.

Acting MS

We have conducted one orientation class to all department heads along with MS. We have informed all that EMR is going to be implemented here in this hospital and we have visited Bayalpata Hospital of Achham and Charikot where we found all the systems good.

HDC Chairman

All the participants said they were communicated about the implementation of EMR system in the hospital through meetings and discussion. Some of the key informants mentioned that observation, orientation and training were provided to the staffs of the hospital regarding the EMR going to be implemented. Those participants who reported that they had missed the training were also assured by the management that they will receive the training department wise. Some of the participants mentioned that they were yet to receive training. In the first phase, training was given to some staff off site so that they can train other staff at hospital then the doctors were given the orientation about the EMR system in the second phase and later the training was staffs in different departments. Some of them also noted that the trainings given were inadequate to understand the system well and shared their assumption that they might learn as they implement. Participants also shared that GIZ had hired IT consultant who was regularly involved in acquainting

participants on EMR.

At first some of the hospital staffs along with medical superintendent have went Dolakha , and again planning to go again to look how the system is running there with a view that it will be easy to give orientation after that .

Pharmacy incharge / store keeper

If we talk about preparation almost all doctors, laboratory colleagues, indoor staffs and departments have taken some kind of training. They are all oriented about electronic medical recording and for logistic, all the equipments and materials are supplied as needed.

Acting MS

I don't know about it, I was not present in meeting too, training was given only one day, it was only once. We are still working on paper but we are also using computer for practice so that it will be easy for us during implementation and we are giving report on paper

LAB assistant

For now our hospital is totally running under Municipality and is preparing to implement it. One basic training has been already completed Basic information has been already given to all staffs, now department wise gradually more trainings are being planned.

Medical Superitendent

About preparation GIZ has hired IT consultant and he is orienting about EMR department wise. It's completed in OPD. It has been started in lab and counter. They are also managing the networking inside the hospital of EMR.

Store Incharge

I have seen IT Officers setting computers in various departments and conducting orientation classes separately for various departments.

OT assistant

EMR was partially implemented in registration section and OPD during the baseline study. Information was recorded in both paper based system and EMR. During the endline study, informants shared that the implementation of EMR has not yet been completed and still in transition as the system has been only executed in OPD, Lab registration and IPD. Among the departments where the EMR has been implemented, it was fully functional in the registration department where the only option to record is in the EMR. OPD and Lab were still using dual recording system both EMR and paper based system. Participants also shared that one of the reason that the EMR was not fully implemented was that they had to update their stocks of logistics like medicine and that in store before integrating everything in EMR which had not yet been completed. Although there were some doubts about the adoption of EMR at staffs level at the beginning, participants shared that it had been well accepted in later stages. Partial implementation of EMR had also created some difficulties relating to duty hand over and opting for completely paperless system.

We got training here in hospital at first and our IT sir taught about EMR practically while we are on work for several days. The process will be completed after the radiology and pharmacy are integrated into EMR system. The reason it has not been started in the pharmacy is that the updating record of the procured drugs has not been completed.

Acting Medical Superintendent

I must say we are still in our transitional phase, It is fully implemented in some department and still on the way in some department, we are not able to dismiss paper system fully so we are running partially.

Medical Officer

We had doubt that we can encourage staff to work on computer or not but opposite to this they are adapting this very fast and are happy to work on EMR system.

HDC Chairman

It is not implemented in all departments till now like the chain system from emergency to here so it is difficult to give handover at the time of duty change. The supporting organization is talking about tab for hospital staffs so that it will be easy while giving handover and describing about patient and while rounding of doctors.

Staff Nurse

I used to feel very difficult to work on EMR system at first but I feel easy nowadays. We ask name, address, sex, and their diseases according to which we send them. When we click on save button it directly goes to the specified department. Its better than paper based system. We are completely doing in computer only.

Counter Assistant

Potential benefits of EMR

Table 13: Potential Benefits of EMR	
Benefits of EMR	
For patients	
Do not need to provide information on repeated visits	
More accurate diagnosis based on past history	
For Hospital	
Reduced cost of paper and printing	
More accurate and reliable data	
Easy to use data for planning	
Reduced time in preparation of report	
Easy maintenance of inventory and financial transparency	
Tool to evaluate staffs performance	
For government	
Reporting in time	
Can be helpful in planning and policy making	

Opinions about the potential benefits of EMR were similar in both the baseline and endline survey. Participants shared potential benefits of implementation of EMR in 3 levels: to patient, to hospital and to government. It would improve diagnosis of the disease conditions, and patients would not require providing all details in each visits as those information would be already recorded in EMR. It would be easy for hospital to plan for service delivery, logistics, staffs and budget as EMR would provide more accurate information about the type of disease prevalent in community, logistics available and required for a year, patients load and financial resources of the hospital. Participants also shared that it would improve efficiency, save time, improve communication, reduce cost of paper and printing, and maintain financial transparency. Participants also shared that immediate availability of data after implementation of EMR would have very positive impact in planning process.

I categorize the advantage of EMR in 3 categories one is for patient party another is for hospital and other is for government. For patient they can know about the services needed to them and , they don't have to speak about their paper and which they have done previously, and for hospital it's good to have all records in hospital and it's also necessary to have all data to government so that it's easy to make plan and policy .?

Hospital Manager

We can give and keep authentic, authorized, good, reliable and long lasting data. Those data can be used for planning's in hospitals, identifying needs of hospital also for business plan, may be some development plans or research, or to know diseases patterns.

Acting MS

I think all leakage will be controlled, that may be from counter, pharmacy, lab or store. We don't know about such leakage till now, where it happens and how it happens, our staffs have also motivated for its use.

Medical Superintendent

Role of EMR in decision making

During baseline study, most of the participants believed that implementation of the EMR could help in decision making of the hospital. Participants shared that as EMR can help in identification of problems at community level, prevalence and incidence of some diseases it can facilitate decision making. Furthermore, as EMR can also improve the information flow from one department to other, it can facilitate the decision making relating to patients care. For example, doctors will have idea about the medicines available in hospital pharmacy before they make any prescription. Participants also had expectation that implementation of EMR would help maintain the financial transparency, resolve conflicts relating to financing and also generate financial summary automatically. One of the most important impact on decision making after implementation of EMR would be on maintenance of hospital inventory as they don't need to count logistics manually and treatment of patients based on

past history. Participants also shared that it can also be important from perspective of evaluating staffs performance and making decisions relating to growth and developments of staffs.

Nowadays evidence based decision making is receiving attention. It would be easy to practice evidence based decision making if EMR is implemented as it would help to generate information about patients, staffs performance, service provided and service gaps in short time. Therefore policy can be made as per the need of the hospital.

Hospital Manager

It will help to take decision , mainly store maintenance and stock clearance , if this system will help only that then also it will be benefit our hospital , at present agendas are presented in the meeting but cannot be passed or decided, another is of manpower , we want to search some paper then I don't find manpower for it.

HDC

During the end line survey, most of the participants thought that it is too early to decide whether it really helps in decision making as the EMR was not fully implemented and recording system of different systems were yet to be linked to each other in same platform. However, similar to that of baseline study participants shared their expectation that it would help in decision making once it's fully implemented. Participants shared that since the data are recorded in real time and are updated, it would be easy to analyze data related to patient flow, stock and inventory, staff performance, number of vacant beds.

Since its not fully implemented and we are also adapting paper based recording system as well, we can't exactly say about its role in decision making. We don't think we have misplaced any data before while we were doing in paper too. But previously due to lack of sufficient staffs, we were not able to enter data in computer.

Lab In charge

As it is still in the developing phase we have not considered this to have impact in decision making. We can still use this as a tool to check which day the patient load more, nature of patient is coming, hospital stay, and duration of stay, which medical officer is seeing the patient in OPD.

Acting Medical Superintendent

It's easy to maintain records, it's easy to see vacant beds, it's also easy to know patients bed no, easy to maintain list, it's easy than paper but sometimes its difficult to manage alone. If the system chain of EMR will be ok then it will be easier for us to work.

Staff Nurse

Potential barriers, challenges and facilitators in Implementation of EMR

Table 14: Facilitators, Barriers and challenges in implementation of EMR

Facilitators

Good team work

Staffs willingness

Commitment from government for sustainability

Appointment of IT staff

Barriers

Staffs not familiar on computer use in workplace

High staff turnover and frequent transfers

Technical issues like power cutoffs, slow server, inadequate backup plan

Absence of manpower for regular repair and maintenance

High patients flow especially during disasters

Most of the key informants stated those staffs in the hospital that are not familiar in using computer and digital recording system and do prefer manual paper based system with some degree of reluctance to move towards the new system. Some mentioned high turnover, lack of adequately skilled staff as the barriers in the implementation. High staff turnover would require training on EMR on regular basis. Since Trisuli District Hospital is government hospital, participants supposed that the frequent transfer of the staffs also could pose challenge to smooth operation of EMR. Newly transferred staffs would require training on implementation of EMR and would also require some time to be acquainted with it. Furthermore, level of motivation of new staffs would also determine the success of EMR. Participants also highlighted other technical barriers like power cut, slow server, and adequate back up plan for data, regular repair and maintenance of the computer that could impede in implementation of EMR. Participants also shared that they might come through new and unexpected challenges after the actual implementation. Furthermore, participants shared that patients might feel that health personnel are not paying attention to them when they see staffs working on computer as patients may not understand the electronic recording process. Furthermore, since the EMR system will have the list of free medicines only, paper has to be used if some medicines need to be prescribed beyond the free medicines as per need of patient.

Doctors may feel burden as they have write on computers and concentrate on doing it which may bring difficulties on patients treatment whereas patient may feel less concentration on them and can say doctors are more busy on laptops and computers rather than diagnosing them so i think this may the potential barriers on the way.

Hospital Manager

There arise technical problems. Recently yesterday our computer stopped

functioning and we could not work at that time and again we had to quickly switch to paper based system.

Counter Assistant.

In pharmacy there are only some certain medicines that we can refer to patient, only free medicines are included in the list of EMR. if we have to give other medicines we need to write on paper then it seems very mess so we need to think on it. The income of hospital is only ticket and investigation. If t can be managed through it then its ok then it has to be managed by municipality.

Medical Officer

Lots of challenges are on the way, we have manpower problems, computers can be crashed any time or it may break, in that case how to manage logistic supplies, how to manage trainings to new staffs , you never know what happens in future therefore it will be difficult for us to manage.

Medical Superintendent.

Clinically in practice we have to do paper work because while rounding we have to carry monitor and go with doctors which is not possible. We will have more workload at that time because we have to do double work , but if we don't need to use paper if it's was made completely paperless then its good , but unless we do it practically we can't say anything.

Staff Nurse

It is easy to work on EMR .We are working smoothly in it but if new staffs comes then it will be difficult to run the work smoothly at that time as you can see staff turnover is very high in this hospital. At that time there should be someone to give training to the new staff, we may give them training but we have to do our daily work so we won't be free at the moment.

Nursing Incharge

During the end line study, some participants shared that advanced technology in itself can be the barrier because people may be reluctant to adoption of change. Participants shared that sometimes when patient load is extremely high like that in case of disaster; it might be difficult to fill up the form in EMR as most of the fields are mandatory. Participants also shared that dual existence of paper based system and EMR had created extra burden which they expected to resolve as EMR is fully implemented. Similar to baseline study, low level of staffs motivation, less knowledge of computer , due lack of adequate staffs to handle technical problems like server down and maintenance of computers were also pointed as barriers in implementation of EMR in endline study as well. Sustainability was other core issue raised by research participants relating to implementation of EMR. Participants doubted if they would be able to sustain the system if GIZ stops providing technical assistance. Since the hospital did not have permanent IT officer, participants had doubts relating to whether they would be able to operate and maintain the system in long run.

Mainly as it is new thing it is more complicated and bothering till one is not

habituated doing that thing; unless other option is available , there is lack of motivating factor; staff has to be motivated, there has to be reward system, there can be a problem due to lack of these two factors.

Acting Medical Superintendent

As it is in the transition period now so it is difficult. It should be entered into the paper and EHR as well so the time is loss in the dual process"

CMA ER Department

The main issue is sustainability of EMR, GIZ is supporting financially in its initial phase but what next? We are also confusing where to keep main server for data backup. We will be facing problem of it if GIZ stop supporting us.

Hospital manager

Participants shared that good team work existing in the hospital, staffs willingness, assurance from the government side for its sustainability, appointment of IT staff to solve the technical problems were some of the facilitators reported by the informants.

If all works jointly co-coordinating with each other then there won't be any obstacles.

Staff Nurse

Potential changes in the system

In both baseline and endline study, participants opined that some changes are needed in the system to make it run smoothly. However, participants shared that since it has not been long since they are using the system, it would not be possible to make concrete and exhaustive list of recommendations. Once EMR is implemented in all departments and systems are integrated to each other, it would be possible to identify the possible changes that are required in the system. Participants also shared that it would be good to develop the system in Nepali language or give option for switching the system between Nepali and English.

It's not implemented till now but its ok according to their concern. Some sets may need to be change but we can say it only after implementing it phase wise .This is just a concept and may need to change while using in field practically as some differences can come in actual field so this can be said after its implementation.

Accountant

Main thing is we have not understood EMR system clearly so can't tell anything about its change , only once we had small class given by possible health friends ,but it was not so clear , if we understand it clearly then we can say what changes are to be done or what improve to be done.

Store Incharge

I saw it I suggested them to keep in Nepali font, we are Nepali then why to use English font.

OT Incharge

Ways to overcome those challenges

Participants shared that the vacant positions has to be filled specially at the leadership level so as to ensure the smooth implementation of EMR. Furthermore, participants shared that there should be some degree of commitment from government side relating to financial and technical assistance that can be crucial in ensuring sustainability of EMR. Participants shared that there should be appointment of permanent IT staff to solve the technical issues they may come through in daily basis. Furthermore, participants shared that nationwide implementation is necessary so that even if the staffs are transferred to Trisuli District Hospital from other parts of country; they won't require additional training on EMR. Participants opined that as it ultimately improves the quality of data and facilitate the decision making process, government should take initiatives in ensuring its sustainability.

Our hospital have to be responsible at first , if our MS , Chairman and Hospital manager do strict to our staff then we can easily implement in my view. It should be maintained in chain system so that everyone has to work on it then only it will be sustainable.

Counter Assistant

About the sustainability of this EMR, According to my knowledge, Trishuli District hospital is the first one to implement EMR among the government hospital but if our government take initiation for the implementation of EMR nationwide then it will be sustainable.

Nursing Incharge

I think the main problem for its sustainability is financial problem, the project runs successfully until it is run by private sector, but when it comes under the authorship of government it will not function well I mean to say we need someone to monitor our task time to time . We need some permanent IT officer for its regular maintenance.

Medical Officer

Summary of findings from Qualitative data

Feature	Baseline survey	End line survey
Implementation status	It was partially implemented in OPD and Registration section at the time of baseline survey.	EMR was implemented fully in the registration, IPD and Emergency. In the OPD and lab there were options available for both paper and e-recording system.

Knowledge on EMR	All participants had some degree of knowledge although they did not have clear understanding about EMR	All the staffs had good understanding of EMR and had received at least a training /orientation.
Task duplication	Patients information recorded in different department separately leading to duplication of tasks	Information of the patients was recorded only once preventing task duplication
Data security	Data were often lost and not readily available	Although the duration since implementation was short, participants expected that data would be retained and available whenever needed
Recording in multiple visits	Every patients were recorded as new patients when they visit hospitals for different disease at different point of time	Information of the patients recorded on their first visit was used for repeated visiting with clear record of their past visits
Confidence regarding EMR	Before implementation participants had confusion about EMR	Participants had idea about EMR and were confident on implementation of EMR
Use of computer	Most of participants were not familiar about the use of computer in recording hospital data	Participants had some degree of familiarity regarding use of computer on recording of hospital data
Effectiveness of EMR	Participants had doubt about effectiveness of EMR	Participants opined that EMR would be effective if challenges are addressed.

CONCLUSIONS

During the baseline survey, EMR was partially implemented in 3 departments and none of the departments had fully implemented EMR while in the endline survey, it was fully implemented in 2 departments and partially implemented in 3 departments. Preparedness in implementation of EMR improved during the endline survey among the staffs.

Endline survey, there were drastic reduction in the percentage of missing information in patient's record on ethnicity, age, gender, district, VDC/Municipality and ward. However, the proportion of missing information seems to have increased in case of other variables like investigation and provisional diagnosis.

Reduction in duplication of task, availability of accurate and updated information, financial transparency, less chance of data loss, prevention of medical errors, reduction in cost of papers and printers, repeated laboratory testing of patients on multiple visits, easiness in evaluation of staffs performance and easiness in financial and logistic planning were key benefits that participants shared would be achieved through implementation of EMR.

Implementation of EMR also drastically reduced time taken to prepare summary about the patients visiting hospital in a day and reporting time to HMIS 9.4. Relatively more participants in endline study said that they used data in influencing different decision made within the hospital after implementation of EMR.

Good team work, willingness of the staffs, commitment from government for sustainability of the program were facilitators in implementation of the EMR while the implementation was hindered by factors like high turnover and frequent transfers of staffs, technical issues like frequent power cutoff, slow server, inadequate backup plan, inadequate manpower for regular repair and maintenance. Participants also shared their experience that patients feel that they are not being paid attention while health personnel consistently look into computer screen for profile of patients and recording of information. Participants suggested that having the system in Nepali language would make it more useful and user friendly.

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ANNEXURE

Annex 1: KII guideline

KII guide (Before Implementation)

SN	Questions	Probing issues
	Please share about medical recording system (Paper based) in your health facility	<p>What works well?,</p> <p>What are shortcomings?</p> <p>Any changes needed?</p>
1	Please share about EMR being implemented in your hospital?	<p>Was it based on your need?</p> <p>What made you think that EMR is needed for your hospital?</p> <p>How decision for implementation of EMR reached</p>
2	What preparations have been done till date to for implementation of EMR?	
3	Do you think implementation of EMR has any role in decision making of the hospital?	<p>In what aspect will it improve decision making?</p> <p>Have you come through any evidences where implementation of EMR has improved decision making?</p>
4	What could be the potential barriers and facilitators in implementation of the EMR?	<p>Barriers</p> <ul style="list-style-type: none"> • Technical • Financial • HR related • Others <p>Facilitators</p> <ul style="list-style-type: none"> • Technical • Financial • HR related • Others
	How do you think these barriers and challenges could be addressed?	<p>Any assistance from GIZ?</p> <p>Any assistance from Govt?</p> <p>Any priorities among barriers to be addressed based on urgency?</p>

5	What could potential benefits of the implementation of EMR?	Financial <ul style="list-style-type: none"> • Time • Quality of data - Accuracy - Reliability - Completeness - Timeliness - Precision - Integrity - Confidentiality • Availability of data
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6	Do you foresee any challenges in implementation of EMR?	Sustainability Support from policy level
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7	Do you think any changes and modifications in EMR system could further improve it?	In implementation plan and activities Change management related aspects
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Anything you want to add that has not been covered in this interview?

KII guide (After implementation)

SN	Questions	Probing issues
1	Please share about EMR has implemented in your hospital?	Did it meet the need/ expectations of your hospital?
2	What activities were carried out in implementation of EMR	
3	Do you think the EMR has facilitated decision making in your hospital?	How has it helped in decision making? Can you share some examples where data from EMR were used in decision making? Have you noticed any positive changes after you have opted for evidence based decision making after EMR implementation? <i>(shortage of logistic and medicines, ease in projection of logistics, equipment and medicines)</i>

4	What were potential barriers and facilitators in implementation of the EMR?	<p>Barriers</p> <ul style="list-style-type: none"> • Technical • Financial • HR related • Others <p>Facilitators</p> <ul style="list-style-type: none"> • Technical • Financial • HR related • Others
5	What are benefits of the implementation of EMR?	<p>Financial</p> <ul style="list-style-type: none"> • Time • Quality of data - Accuracy - Reliability - Completeness - Timeliness - Precision - Integrity - Confidentiality • Availability of data
6	Do you foresee any challenges in implementation of EMR in near or distant future?	<p>Sustainability</p> <p>Support from policy level</p>
7	Do you think any changes and modifications in EMR system could further improve it?	<p>In implementation plan and activities</p> <p>Change management related aspects</p>
<p>Anything you want to add that has not been covered in this interview?</p>		

Annex 2: Document Review Checklist

	Before implementation of EMR	After implementation of EMR
% units that are entering data in the EMR		
% of hospital staff that has been trained is the using EMR		
% missing data variables in the OPD registry		
Number days/month it takes until data is available in HMIS 9.4		
Time it takes to retrieve a past patient records.		
% of information that is not in the same data format for the same category of data entry and/or not matching an agreed standard.		
% data entities that appear more than once but are the same		
Personal data are not disclosed inappropriately, and that data are treated with appropriate levels of security		

Annex 3: Readiness assessment tool for Medical Superintendent

Domain 1. Organizational alignment

No	Item	1	2	3	SCORE
1,1	The EHR planning process includes...	Top management and/or designated investigator only	Key planners or departments and is participatory	All departments, is team-oriented and emphasizes communication and collaboration.	
1,2	Physician involvement in the EHR process...	Is limited to a physician advocate to represent clinical interests.	Primarily occurs for key decisions; clinical interests are valued.	Is active in planning and decision-making; clinical and managerial interests are aligned.	

1,3	The clinic has the ability and tendency to...	Embrace limited amounts of change; new solutions and programs are created in response to significant pressure or funding opportunity.	Modify existing processes when faced with significant change.	Embrace change and create new solutions.
1,4	Physicians...	Do not connect EHR technology with quality or efficiency improvement goals	Are generally aware of EHR in conjunction with the quality or efficiency improvement goals	Can clearly articulate how EHR technologies support quality and efficiency goals
1,5	Project and change management is...	Supported, but it is not a high priority or developed skill-set.	Viewed as important	Strong and viewed as a key investment to achieve success.
1,6	Data is...	Not used regularly to solve problems	Viewed as one component of decision-making, but is not viewed as a tool to find solution	A key part of the management mindset and viewed as critical to preventing problems, improving efficiencies and care delivery.
1,7	The senior management (HDC or else) has...	Discussed the need for EHR technology but has not been closely involved in the initiative.	Discussed and approved the need for EHR technology to support clinical quality goals and will receive progress reports periodically	Discussed and approved EHR strategy, created an EHR subcommittee and will receive progress reports regularly.

1,8	A communication plan about EHR implementation and related responsibilities, change management plans and quality care improvement goals...	Has not been developed	Is being developed to educate management and staff, but is limited to generic information about EHRs only.	Is in place to educate management and staff.
1,9	Efficiency and quality goals ...	Have not been defined	Have been defined but are broad and not measurable.	Have been defined and progress is measured regularly.
1,10	Leadership...	Is divided as to how important EHR actually is for the facility.	Has studied the pros and cons of implementing an EHR and can make an argument for why benefits outweigh costs.	Understands the benefits of the EHR and risk of failed implementation, and sets a clear and consistent vision for how EHR supports efficiency and quality improvement goals.
1,11	The Executive team...	Relies substantially on external assistance to provide EHR planning guidance	Delegates EHR planning to managers or a specific team.	Devotes substantial time to EHR planning and execution
1,12	Physician leader(s)...	Are not involved in the EHR planning process	Create clinical EHR requirements without input from other physicians or staff.	Are aligned with administrative leaders and incorporate consensus based needs into EHR requirements
1,13	Leadership sets...	No tone and does not engage in consensus building efforts for implementation.	The tone for implementation with general consensus and partial physician buyin.	Future direction, positive tone for implementation and aligns staff for integration of EHR into workflow

1,14	The Executive team has designated...	Limited staff time to EHR implementation activities	time for key management to prepare for EHR implementation	Substantial staff time from multiple departments for EHR implementation.
1,15	A strong physician champion...	Does not exist.	Exists	Exists and is well respected by physicians and staff.
1,16	A timeline for expected benefit realization...	Has not been defined.	Has been generally estimated	Has been defined for each functional area to be implemented.
Sub-total				.../30

Domain 2. Management Capacity

No	Item	1	2	3	SCORE
2,1	Staffing needs for EHR implementation and use...	Have not been analyzed.	Are generally understood, but a staffing plan has not been developed.	Have been documented in a staffing model, detailing current staffing and proposed needs; requirements have been included in the planning process.	
2,2	Staff dedicated to change management and quality improvement...	Have not been specifically identified.	Have a basic understanding of EHR functionality and are participating in the EHR decision-making process.	Are experienced, have been educated about EHR functionality and workflow impacts, are authorized to lead the decision-making process and will work closely with management to resolve issues throughout the process.	

2,3	Financial and non-financial incentives for physicians and staff users for EHR adoption...	Have not been considered	Have been discussed by leadership and an individual assigned to develop plan	Have been analyzed and a multi-departmental planning process is in place to develop appropriate incentives
2,4	A project manager is...	In place with less than 100% of time allocated to project.	Fully allocated to manage project but full scope of authority and accountability is still not clear.	Strong, fully allocated, authorized, and a methodology is in place to manage the project.
2,5	Staff to fill EHR implementation roles and responsibilities...	Have not been determined	Will be made available	Have been designated and division of labor and accountability clearly articulated.
2,6	EHR users will...	Not be involved in testing the EHR prior to going live and are not encouraged to submit functionality problems or enhancements for resolution.	Participate in EHR user acceptance testing and are encouraged to submit functionality problems or enhancements to the help desk.	Have super users (subject matter experts) available to them to help resolve functionality issues or propose usability enhancements.
2,7	Staff allocated to support EHR use is...	Are allocated to support data generation, but few, if any resources are assigned to data analysis.	Adequate and have been allocated to support data generation and data analysis functions.	Adequate, appropriate and have been allocated for workflow oversight and data analysis.
2,8	Staff understands...	The general idea, but have not been formally educated on their role or the importance of data and information flow in the patient care process	Their role in the patient care process, but have not been educated about the importance of data and information flow.	End-to-end data and information flow and their role in the patient care process.

2,9	Assessment of staff model modifications and staff redeployment	Has not been analyzed.	Has been conducted	Has been conducted and a staff plan is in place.
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2,10	Oversight and progress reporting on physician EHR adoption will be	Managed by various non-physician leaders	Managed by non-physician leaders with physician leadership support.	The responsibility of a physician executive who will report directly to the senior management.
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2,11	Reporting on EHR implementation and adoption progress...	Will be delivered verbally to executive management	Will be communicated periodically to executive management and the board.	To the senior management will be systematic, metric-based and will include a report on project plan milestones
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Sub-total				.../30
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Domain 3: Operational Capacity

No	Item	1	2	3	SCORE
3,1	Implementation is designed for roll-out in	A one-phase event	Two-phase events	Increments	
3,2	a project plan, assigning specific responsibilities, defining milestones and adaptation processes	Does not exist	Is currently being developed	Has been developed and will be continuously adjusted	

3,3	EHR user feedback and issue resolution	Will be handled on an ad hoc basis and resolutions communicated as necessary.	Is managed by a key representative designated to provide EHR feedback to management and communicate resolutions to users	Is managed through a cross-departmental team of Super Users that shadow physicians and staff, meet regularly with management to discuss issues, incorporate findings into training plan and communicate EHR-specific messages and resolutions to users.
3,4	A formal training plan...	Is not in place; clinical and administrative staff will receive training on-the-job	Including EHR implementation and skill set gaps is being developed for necessary physicians and key staff.	Including EHR implementation, workflow redesign and skill-set gaps is in place for management, physicians and staff.
3,5	Current workflows...	Are not clearly defined.	Are clearly defined but not documented	Are clearly defined and documented.
3,6	The new EHR...	Will not incorporate current workflows, because of too high costs for customization	Will partially incorporate current workflows.	Will fully incorporate current workflows

Sub-total

.../30

Domain 4: Technical Capacity

No	Item	1	2	3	SCORE
3,1	Implementation is designed for roll-out in	A one-phase event	Two-pahse events	Increments	

3,2	a project plan, assigning specific responsibilities, defining milestones and adaptation processes	Does not exist	Is currently being developed	Has been developed and will be continuously adjusted
3,3	EHR user feedback and issue resolution	Will be handled on an ad hoc basis and resolutions communicated as necessary.	Is managed by a key representative designated to provide EHR feedback to management and communicate resolutions to users	Is managed through a cross-departmental team of Super Users that shadow physicians and staff, meet regularly with management to discuss issues, incorporate findings into training plan and communicate EHR-specific messages and resolutions to users.
3,4	A formal training plan...	Is not in place; clinical and administrative staff will receive training on-the-job	Including EHR implementation and skillset gaps is being developed for necessary physicians and key staff.	Including EHR implementation, workflow redesign and skill-set gaps is in place for management, physicians and staff.
3,5	Current workflows...	Are not clearly defined.	Are clearly defined but not documented	Are clearly defined and documented.
3,6	The new EHR...	Will not incorporate current workflows, because of too high costs for customization	Will partially incorporate current workflows.	Will fully incorporate current workflows
Sub-total				.../30

Annex 4: Change Readiness assessment tool for hospital staffs involved in implementation of EMR

Domain 1: IT Skills

No.	Question	0 - strongly disagree	1 - disagree	2 - neither nor	3 - agree	4 - strongly agree
1	I am confident working with hardware components of a computer system (e.g. touch screen, hard disk, keyboard, and mouse).					
2	I am confident working with software components of a computer system (e.g. a word processor – Microsoft Word, a spreadsheet – Microsoft Excel, an electronic mail application – Microsoft Outlook).					
3	I use computers for various purposes (e.g. internet browsing, sending and receiving emails, online transaction – shopping or banking, printing documents).					
4	I have worked with electronic medical record systems before.					
5	I am confident to be able to work with an EMR system.					
SCORE						.../20

Domain 2: Organizational support skills

No.	Question	0 - strongly disagree	1 - disagree	2 - neither nor	3 - agree	4 - strongly agree
6	Overall, I received sufficient information regarding the implementation of the EMR system.					
7	I received sufficient feedback if I had any questions regarding the implementation. (to be left out, if there were no questions)					
8	I am encouraged by the senior manager(s) to embrace the EMR system implementation.					
9	I am confident the implementation of the EMR is a priority for the senior management and my supervisors.					
10	Overall, our facility is used to change processes.					
SCORE						.../20

Domain 3: Expected Benefits

No.	Question	0 - strongly disagree	1 - disagree	2 - neither nor	3 - agree	4 - strongly agree
11	I believe the EMR implementation can lower medical error.					
12	I believe the EMR implementation can improve the management of care of the patients.					
13	I believe the EMR implementation may increase the reliability of the patients' records.					

14 I believe the EMR implementation can improve the overall efficiency of the hospital.

15 I believe the EMR implementation will help in transferring patient's record from one department to another.

SCORE

.../20

Domain 4: Motivation and Understanding

No.	Question	0 - strongly disagree	1 - disagree	2 - neither nor	3 - agree	4 - strongly agree
16	I am looking forward to the changes that the hospital will go through due to the EMR.					
17	I am looking forward to use the EMR.					
18	Overall, I believe the EMR will be beneficial to my particular work.					
19	Overall, I have a profound understanding of the reasons behind the implementation of EMR.					
20	Overall, I have a profound understanding of what goals are to be met through the implementation of EMR.					

SCORE

.../20